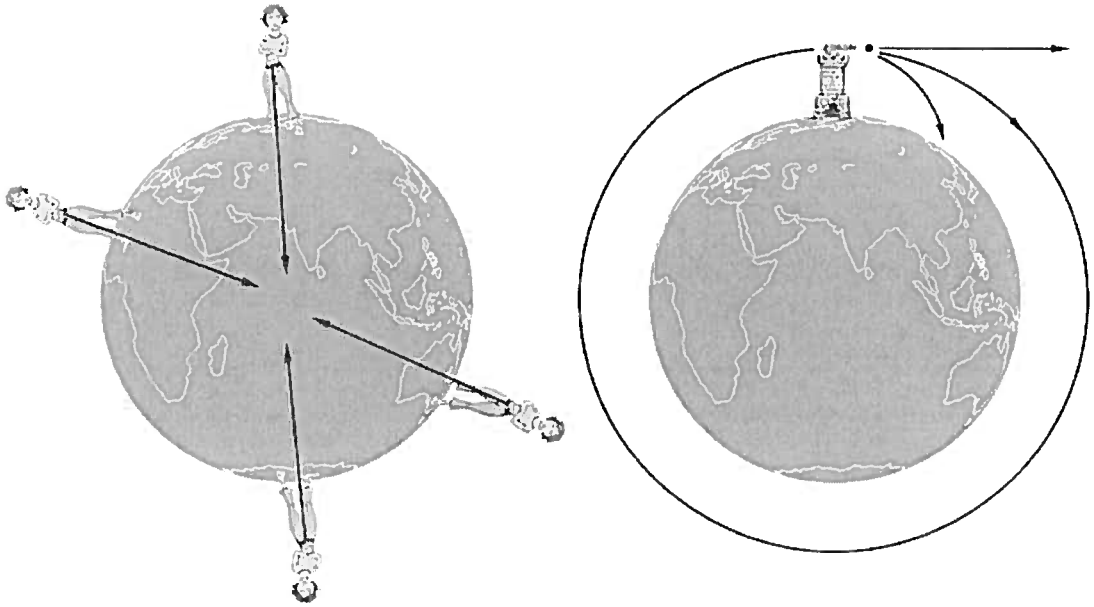
LIFT vs GRAVITY

Sir Isaac Newton, an English scientist, observed the force of gravity when he was sitting under a tree and an apple fell on his head! It is a strong force that pulls everything down toward the earth. The more mass, the more gravity pulls. The lighter the object the less lift required to make it buoyant (able to float on air).

Jump up into the air – and stay there! What happens? Do you know of any place that does not have gravity or much less gravity? Drop a pencil, rock and a ball. What happens? What does this mean for bigger and heavier airplanes?

When you lift things up you have to pull against gravity. If you drop a pencil, gravity pulls it to Earth. If you rest its mid-point on your finger, gravity will pull down equally on both sides of the pencil and it will balance in the air.

The attractive force of gravity acts between at the center of two objects. In the case of people standing on the earth's surface, the effect of gravity is to attract us towards the center of the earth. As a result, no matter where you stand on the earth, you don't fall off. Gravity is also the reason why the moon (and satellites) orbit the earth and why we orbit the sun.



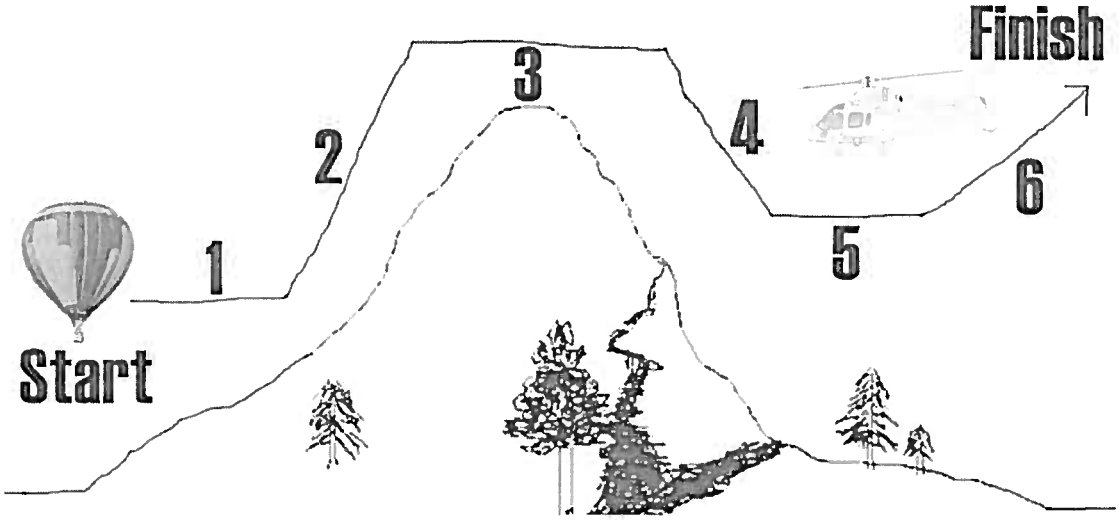
Lift is the upward force used to overcome gravity and to achieve flight. Lift occurs if the force on the bottom of an object is greater than the force of gravity from above. To sustain a particular height, lift must equal gravity).

Lift vs. Gravity Questions:

Answer the following questions on looseleaf.

1. All objects within the Earth's atmosphere are pulled downward by _____.
2. The upward force that enables an object to fly is called _____.
3. In order to fly, objects must overcome _____ and attain _____.
4. The greater the mass of the object, the _____ the attraction of gravity.
5. The greater the mass of the object, the _____ the force of lift required.

6. Identify the relationship between gravity and lift at each interval indicated in the diagram below.



7. Since lift is required to make an object fly, why is it important that Engineers make flying devices as light as possible?

Floating and Sinking in Fluid Air

The first hot-air balloon was launched near Paris, France in 1783. It had a mass of more than 600 kg. Even so, the balloon could hold enough hot air to lift off and float in the air for 10 min before returning to the ground about 1 km away. A huge straw fire was built under the open end of the balloon to supply hot air.

By now, you can probably name many materials that are "natural floaters" in water. You also know that materials which are "natural sinkers" can be made to float. All it takes is a little reshaping so they hold lots of air.

But a "natural floater" in one fluid may be a "natural sinker" in another. This is certainly true for air. The upward buoyant force that air exerts on objects is usually too small to balance the downward force of gravity on them. So even an air-filled balloon will sink in air. In fact, only a few materials are able to float in air.

One material that floats in air is hotter air! If you measured equal volumes of hot and cold air on a balance, you would find that the hot air has less mass than the cold air. That means hot air can float up through cold air. And that means it's possible to help air sinkers become air floaters. This is what two brothers did in 1783, when they designed, built, and successfully launched the world's first hot-air balloon.

Name: _____

Experimenting With a Helium Balloon

Attach paper clips to the string on your helium balloon to alter the balloon's mass and density. Predict and record the number of paper clips required to float the balloon at different heights above the ground.

Floating Height (in meters)	Number of Paper Clips Required	Number of Paper Clips Required
	Prediction	Result
Ceiling		
Floating		
Touches Down		

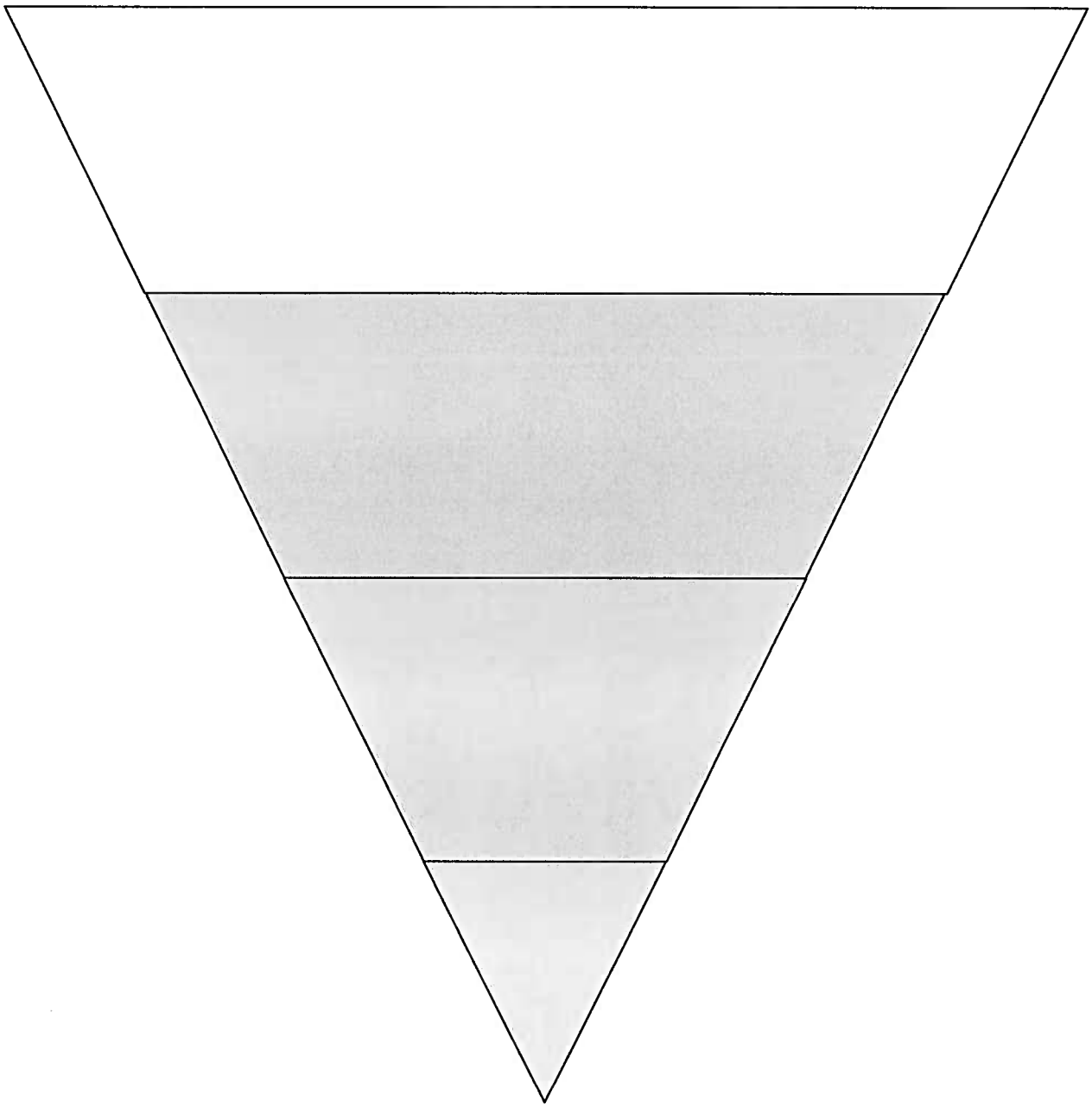
1. Why do helium balloons float in air?

2. How did you control the height at which the balloon floated?

3. If the air in our classroom was much warmer, would it change the number of paper clips required to "sink" the helium balloons? Explain.

DENSITY TOWER

1. Draw 10 dots (spread out) in each of the sections. 2. Place the words below into the correct section of the tower (or beside the correct section).



Most Dense	Helium	Air	Least Dense
Hot Air	Little Density	Water	Little Density